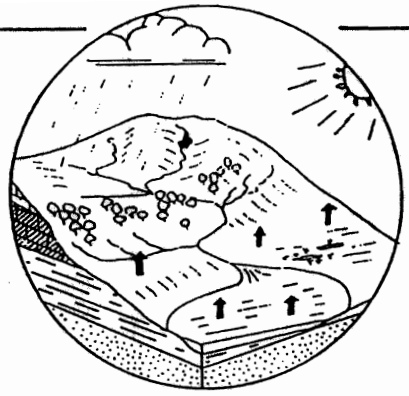
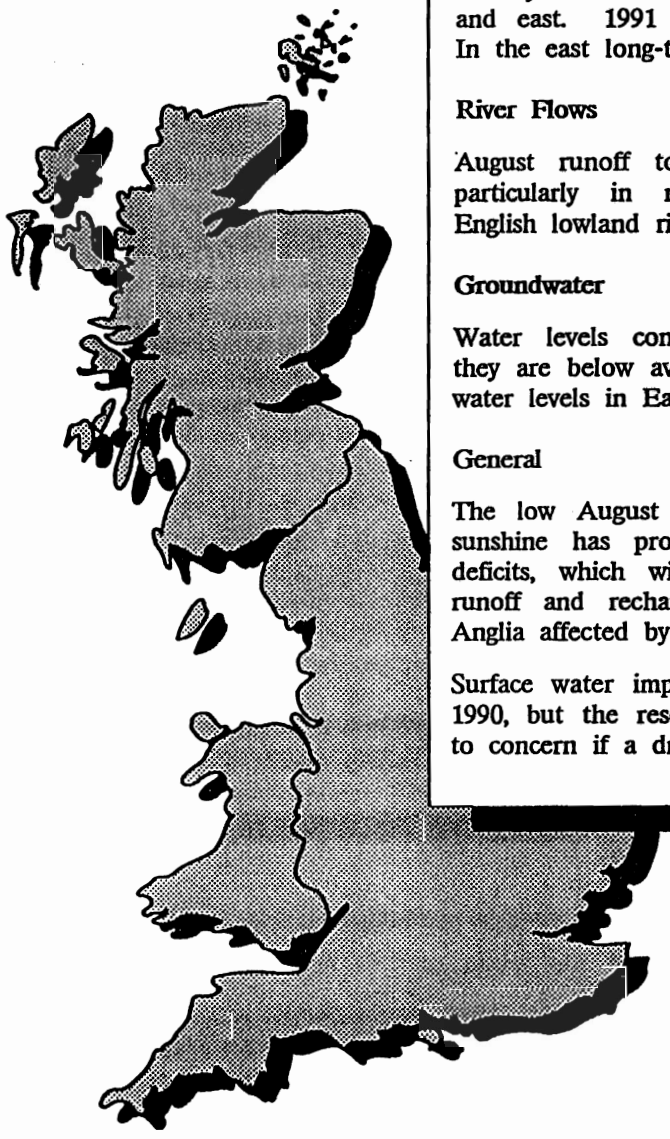
Hydrological Summary for Great Britain





AUGUST 1991

Rainfall

Provisional figures indicate that rainfall was 43% of average over Great Britain; the sixth driest August this century. Lower proportions were recorded in the south and east. 1991 rainfall totals are in the normal range. In the east long-term deficiencies continue to increase.

River Flows

August runoff totals were predominantly below average, particularly in responsive catchments. Flows in some English lowland rivers are among the lowest on record.

Groundwater

Water levels continued their seasonal decline; generally, they are below average but above long-term minima. Some water levels in East Anglia are very depressed.

General

The low August rainfall, high temperatures and plentiful sunshine has provoked sharp increases in soil moisture deficits, which will serve to delay seasonal recovery of runoff and recharge rates, particularly in areas of East Anglia affected by long-term drought.

Surface water impoundments are healthier than in August 1990, but the resources outlook in the east will give rise to concern if a dry autumn occurs.

Institute of Hydrology

British Geological Survey

HYDROLOGICAL SUMMARY FOR GREAT BRITAIN - AUGUST 1991

Data for this report have been provided principally by the regional divisions of the National Rivers Authority in England and Wales, the River Purification Boards in Scotland and by the Meteorological Office. Reservoir contents information for England and Wales has been supplied by either the Water Services Companies or the NRA. The most recent areal rainfall figures are derived from a restricted network of raingauges (particularly in Scotland) and a proportion of the river flow data is of a provisional nature.

A map (Figure 4) is provided to assist in the location of the principal monitoring sites.

Rainfall

August, on average, is a wet month; in most eastern and some northern regions the wettest of the year and over the British Isles as a whole the wettest summer month (June- August). In 1991 this summer pattern was reversed; August was a notably dry month throughout the British Isles, particularly England and Wales, where only 33% of average rainfall was received - the sixth driest year this century. The corresponding estimate for Scotland was 55%, 12th driest this century.

Spatial variation followed the pattern established over the last three years, of an accentuation of the west-east rainfall gradient; rainfall exceeded 50% of average only in the north west of Scotland, Dumfries and Galloway and Cumbria, the northern mountains of Wales and other smaller scattered inland or coastal areas which were in receipt of some storm rainfall. Much of central southern England, southern Yorkshire, Nottinghamshire and Lincolnshire received less than 25% of average rainfall. Within this area, pockets in Humberside, Warwickshire and Oxfordshire and the coastal fringe from the Isle of Wight to Sussex received between zero and 10% of average.

Taking the summer months as a whole, a different picture emerges. The southern England NRA regions all have 3-month rainfalls around or above average. Rather drier conditions obtained in the Yorkshire, Anglian and northern NRA regions and the borders, being less than 75% of average. Long term deficiencies over durations greater than two years have been exacerbated; for the Anglian region the 37-month precipitation shortfall is about 400 mm - against an average annual precipitation of 610 mm.

Those areas in Lincolnshire southwards towards Kent, which have been experiencing severe drought conditions have seen no relief in August, leading to further depressions of runoff and recharge rates (see below).

Evaporation and Soil Moisture Deficits (SMDs)

Temperatures were above average throughout the British Isles in August, with the eastern Grampian region, coastal Lincolnshire and the home counties showing the most notable increases. Sunshine hours were also generally above average, particularly along the coast from Norfolk to Kent, but fell below average in north western and central southern Scotland and around Morecombe Bay.

Potential evaporation (PE) losses during August were predominantly above average nationwide, apart from Wales and the South West. The drier areas in the eastern lowlands and the north of Scotland experienced PE well above the mean. Apart from Scotland and the north west of England, PE losses were short of those achieved in 1990 by 5-20 mm. Actual

evaporation losses were above average in the north and the west - markedly so in Scotland where some areas have calculated AE as the second or third highest in a 31-year record. Moving east the higher SMDs led to significant shortfalls of AE below PE in those areas currently affected by long-term droughts. In the Lower Trent area AE was half the August 1990 value, and the second most severe in the 31-year record. Generally in the east, however, AE losses were above 1990 values. In all cases in the east the shortfall of AE below PE was less than recorded in 1990, often markedly so.

Accumulations over the year 1991 generally have PE losses below average, apart from the North West and western Scotland. Along the Welsh borders PE totals are the lowest on record. AE accumulations are similarly low in most eastern and southern areas.

All of Great Britain experienced a rise in SMDs through the month, particularly into the beginning of September. By the end of August, large tracts of central and eastern England were experiencing SMDs over 100 mm, whilst maximum SMDs for the MORECS (grass) model (125 mm) had been reached in Lincolnshire, south Humberside and the lower Trent valley. Comparison with the long-term average indicates that most of Great Britain was recording SMDs above the mean at the end of August, albeit only marginally so in western Scotland, Wales and southern England. Areas of below average SMD were restricted to southern Devon and Cornwall, Kent and East Sussex and parts of Wales and western Scotland. Over central and eastern England, August 1991 SMDs were typically 20-50 mm higher than the average whilst in the eastern Borders region the difference was as high as 65 mm.

The areal extent of maximum SMDs at the end of August 1991 is far smaller than that in 1990, when it covered most areas south and east of a line from South Wales to Flamborough Head in Yorkshire. The end of August 1991 situation exhibited a smaller SMD variation and a lower west to east SMD gradient than August 1990 - with no areas of zero SMD. SMDs are less severe than a year ago for most regions outside of East Anglia.

Runoff

Over much of England the bulk of the August rainfall was concentrated into one or two short episodes leading to recessions which were steep and prolonged through to the end of the month. All bar one of the index catchments recorded below average runoff, with the greatest departures in the north (apart from Highland dominated catchments in Scotland) and the west. This was a reflection of the more restricted catchment storage in these areas. Responsive catchments, particularly along the south coast, receded sharply from the rains of June and July and at month end were approaching flows comparable with the summers of 1983 and 1984, although above those of 1976, 89 and 90.

For the base-flow dominated rivers of the English lowlands, August rainfall was insufficient to resist the continuance of, or return to, flow recession. Over wide areas flows were well below average, although not approaching historical minima (typically 1976 for August flows); in general they were above flow rates registered in August 1990.

For 1991 as a whole runoff from the North, West and Scotland (away from the east coast) was well within the normal range, with Scottish accumulations generally being above average. Only in the east Midlands into Lincolnshire and Cambridgeshire did 1991 accumulations appear unusually low; the Trent at Colwick ranked 2nd in a 33 year record for January-August runoff totals, as did the Lud at Louth and the Little Ouse at Abbey Heath. When the durations under examination exceed 18 months then other eastern and southern catchments exhibit notably low accumulations. The Lud at Louth duly recorded its 34th month below average and at many sites only the exceptional rainfall of the first quarter of 1990 has prevented similar long durations remaining below average.

The areas affected by long-term runoff deficiency probably require more than one wet year, or an exceptionally wet year, to restore average flow regime conditions, as any recovery must commence from a low base (assuming an average within-year rainfall distribution). The same low base conditions, however, would conspire with a dry autumn to arouse serious concern for prospective flow conditions, even if the rainfall was not as restricted as it was, for instance, in 1989.

Notwithstanding the dry August, reservoir contents show only moderate reductions, if at all, from July. Appreciable natural inflows into some Welsh reservoirs reduced the effects of increased abstraction for supply or river support. Low river flows towards the end of the month may have restricted abstractions to sustain pumped storage reservoirs but the overall reservoir contents situation and outlook is reasonably healthy, even in the drought affected areas in the east and south east, and more encouraging than at a similar time in 1990.

Groundwater

In general, groundwater levels continued to fall throughout August within the outcrop areas of all major aquifers. The slight slackening due to the July rainfalls in southern England has not been continued.

The very limited recharge in eastern areas is the major influence on groundwater levels in August 1991; the effects of the droughts of 1989 and 1990 ensured that the summer recessions of 1991 started at levels generally much below normal. In the Chalk, the groundwater levels remain very depressed east of a line from the Humber to Sussex, although local variations in the amount of 1990/91 recharge are an important factor. At the Fairfields and Redlands sites in the East Anglian Chalk, levels are at their lowest for August for the period of record, while at Washpit Farm, a little further north, the August level was the lowest on record for any month, eclipsing the minima of 1973 and 1976. At Little Brocklesby in Humberside and Little Bucket Farm in the south-east, groundwater levels are also extremely low although still somewhat above the 1976 minima. Chalk groundwater levels in the Darent catchment are among the lowest on record as are those in the Lower Greensand of north Kent and East Sussex.

In the Permo-Triassic sandstones of the Midlands, groundwater levels have also continued to fall; at the Morris Dancers site in the Trent basin, the August level has been lower upon only one other occasion during that month in a 22- year record. At the Llanfair DC site in North wales, the groundwater level is also at the second lowest level in a 19-year record.

Just as fairly modest winter rainfall deficiencies combined with persistent soil moisture deficits can result in especially depressed groundwater levels particularly in eastern and central districts of England, the especially dry weather pertaining through August 1991 will have deepened the soil moisture deficits across most of the country. The necessity of satisfying these deficits may well set back effective infiltration into the late autumn or early winter. The result may be a significant shortening of the 1991-92 recharge season.

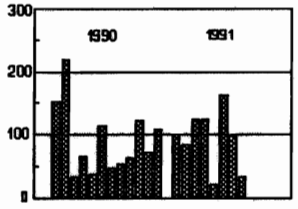
TABLE 2 RAINFALL RETURN PERIOD ESTIMATES

		JAN - AUG 91	Est Return Period, years	SEP 90 - AUG 91	Est Return Period, years	MAY 89 - AUG 91	Est Return Period, years	AUG 88 - AUG 91	Est Return Period, years
England and	mm	503		827		1840		2483	
Wales	% LTA	90	2-5	91	2-5	87	10-20	88	15-25
NRA REGIONS									
North West	mm	568		1053		2449		3459	
	% LTA	77	10-20	87	5-10	87	10-20	92	5-10
Northumbria	mm	512		860		1749		2348	
	% LTA	92	2-5	98	2-5	85	15-25	86	20-30
Severn-Trent	mm	426		704		1583		2088	
	% LTA	87	2-5	91	2-5	87	10-15	87	15-25
Yorkshire	mm	421		729		1611		2915	
	% LTA	80	5-10	87	5-10	83	30-40	85	20-40
Anglian	mm	299		482		1122		1501	
	% LTA	77	10-15	79	15-20	78	80-120	79	150-200
Thames	mm	431		625		1389		1838	
	% LTA	98	2-5	89	2-5	84	10-20	84	20-30
Southern	mm	496		767		1606		2089	
	% LTA	106	2-5	97	2-5	88	5-10	85	20-30
Wessex	mm	519		784		1764		2353	
	% LTA	100	<2	90	2-5	88	5-10	88	10-15
South West	mm	727		1154		2596		3472	
	% LTA	103	2-5	97	2-5	95	2-5	94	2-5
Welsh	mm	766		1278		2847		3868	
	% LTA	97	2-5	96	2-5	93	2-5	94	2-5
Scotland	mm	810		1465		3525		4960	
	% LTA	96	2-5	102	2-5	107	5-10	112	30-50
RIVER PURIFICATION BOARDS									
Highland	mm	929		1776		4431		6300	
	% LTA	92	2-5	103	2-5	113	20-30	119	>200
North-East	mm	548		962		2078		2822	
	% LTA	86	5-10	94	2-5	87	15-25	89	15-25
Tay	mm	749		1215		2889		4101	
	% LTA	98	2-5	97	2-5	99	2-5	106	2-5
Forth	mm	668		1129		2636		3659	
	% LTA	97	2-5	101	2-5	101	2-5	106	5
Tweed	mm	583		1016		2162		2885	
	% LTA	93	2-5	101	2-5	92	5-10	92	5-10
Solway	mm	828		1395		3201		4517	
	% LTA	99	2-5	98	2-5	98	2-5	103	2-5
Clyde	mm	969		1762		4278		5996	
	% LTA	102	2-5	106	2-5	113	15-25	117	90-120

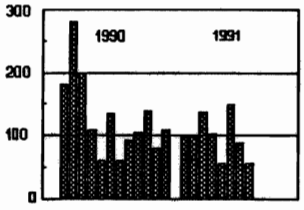
Return period assessments are based on tables provided by the Meteorological Office*. These assume a start in a given month; return periods for a start in any month may be expected to be an order of magnitude less.
The tables reflect rainfall totals over the period 1911-70 only and the estimate assumes a sensibly stable climate.

* Tabony, R C, 1977, The Variability of long duration rainfall over Great Britain, Scientific Paper No. 37, Meteorological Office (HMSO)

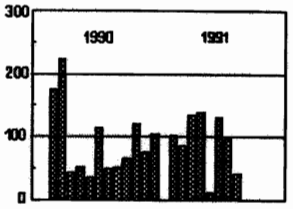
FIGURE 1. MONTHLY RAINFALL FOR 1990-1991 AS A PERCENTAGE OF THE 1941-1970 AVERAGE



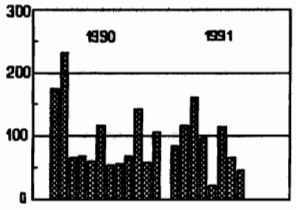
England and Wales



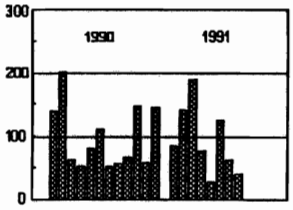
Scotland



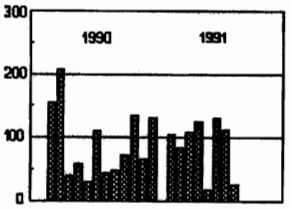
Welsh Region



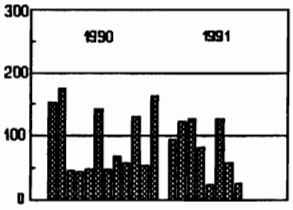
North West Region



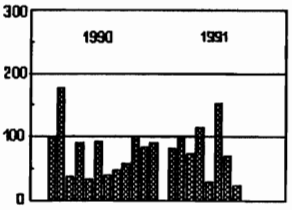
Northumbria Region



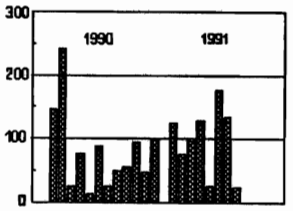
Severn-Trent Region



Yorkshire Region



Anglian Region



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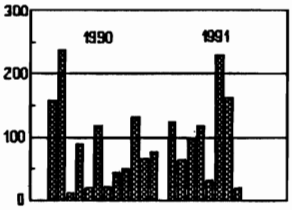
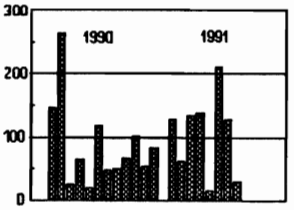
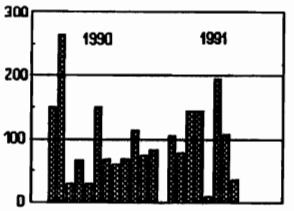


Southern Region

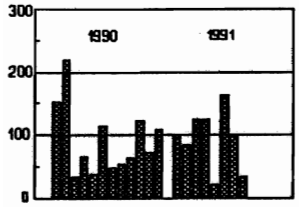


Wessex Region

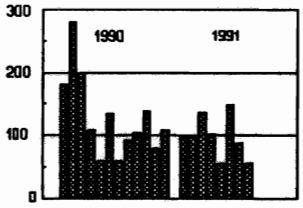


South West Region

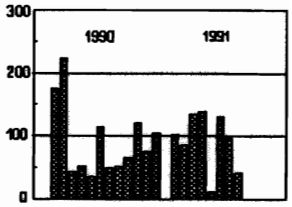
FIGURE 1. MONTHLY RAINFALL FOR 1990-1991 AS A PERCENTAGE OF THE 1941-1970 AVERAGE



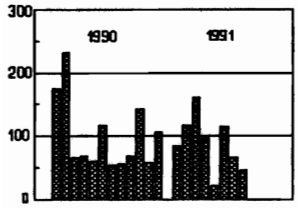
England and Wales



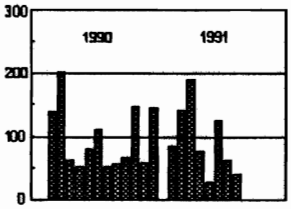
Scotland



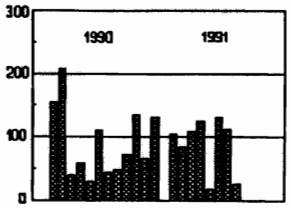
Welsh Region



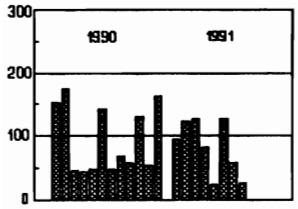
North West Region



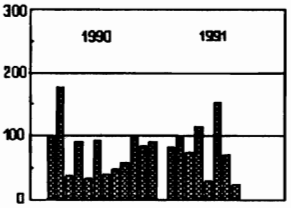
Northumbria Region



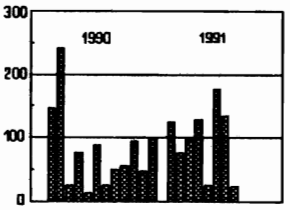
Severn-Trent Region



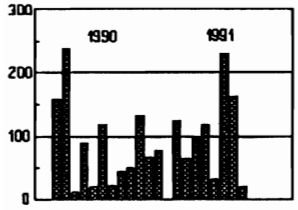
Yorkshire Region



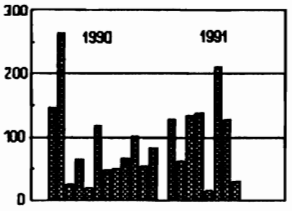
Anglian Region



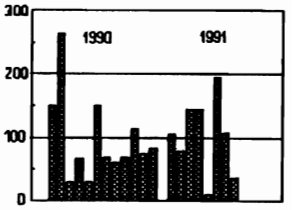
Thames Region



Southern Region



Wessex Region



South West Region

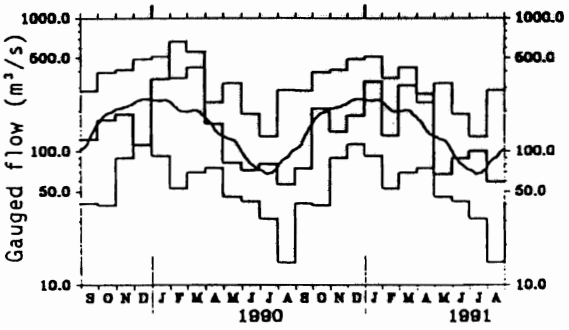
TABLE 1 1990/91 RAINFALL AS A PERCENTAGE OF THE 1941-70 AVERAGE

		Jul 1990	Aug	Sep	Oct	Nov	Dec	Jan 1991	Feb	Mar	Apr	May	June	July	Aug 1991
England and	mm	35	46	53	103	67	101	92	63	75	68	14	92	69	30
Wales	%	47	51	64	124	69	112	107	97	127	117	21	151	95	33
NRA REGIONS															
North West	mm	58	73	86	175	73	151	98	86	89	61	16	96	65	57
	%	56	58	70	148	60	126	88	106	124	79	20	116	63	46
Northumbria	mm	40	53	53	107	61	127	83	114	84	40	23	73	55	40
	%	52	52	66	143	65	169	104	173	162	73	36	120	71	39
Severn-Trent	mm	27	37	46	93	52	87	77	41	59	66	11	74	77	21
	%	42	46	69	143	66	124	112	77	113	127	17	132	118	26
Yorkshire	mm	32	47	39	92	55	121	71	89	62	49	15	74	37	24
	%	46	52	54	133	62	164	92	139	117	88	24	128	53	26
Anglian	mm	21	31	32	51	53	47	44	39	29	44	13	77	38	15
	%	37	48	62	98	85	89	85	93	73	110	28	157	67	24
Thames	mm	17	35	34	58	34	68	80	39	45	62	14	96	79	16
	%	28	50	55	91	47	103	129	83	98	135	25	185	132	23
Southern	mm	13	33	38	105	63	65	98	40	59	56	17	125	87	14
	%	22	45	54	135	67	80	129	70	113	117	31	250	147	20
Wessex	mm	31	41	49	87	51	78	108	43	88	69	9	106	73	23
	%	50	50	62	106	53	87	129	73	152	128	13	196	118	29
South West	mm	61	59	69	128	106	124	153	82	127	99	10	127	91	38
	%	73	58	66	113	79	92	119	91	151	139	12	195	108	37
Welsh	mm	53	64	85	152	112	163	151	96	125	121	15	110	98	50
	%	56	54	68	118	78	112	111	100	144	141	16	134	103	42
Scotland	mm	75	119	149	213	102	191	151	83	128	121	43	121	92	71
	%	67	92	109	143	72	122	110	80	139	134	47	132	82	55
RIVER PURIFICATION BOARDS															
Highland	mm	93	156	234	225	147	241	180	70	141	129	67	124	108	110
	%	73	105	148	121	87	123	110	53	124	113	66	113	85	74
North-East	mm	43	75	86	136	95	97	60	77	80	59	48	128	57	39
	%	47	70	99	140	92	95	66	104	129	97	61	183	62	36
Tay	mm	38	73	68	186	63	149	154	89	117	107	22	136	91	33
	%	37	62	59	152	53	111	131	97	143	143	23	164	89	28
Forth	mm	49	83	68	194	56	143	133	84	104	90	19	108	96	34
	%	50	72	63	183	52	131	134	109	151	132	22	144	98	29
Tweed	mm	52	61	69	159	53	152	110	103	93	60	20	89	65	43
	%	58	54	74	181	51	169	118	149	160	98	21	131	73	38
Solway	mm	74	106	81	218	77	191	144	108	153	146	18	121	77	61
	%	67	82	54	151	53	126	103	116	168	166	17	134	70	47
Clyde	mm	96	151	172	301	94	226	187	88	162	181	35	129	110	77
	%	74	106	98	164	56	122	116	78	154	176	36	125	85	54

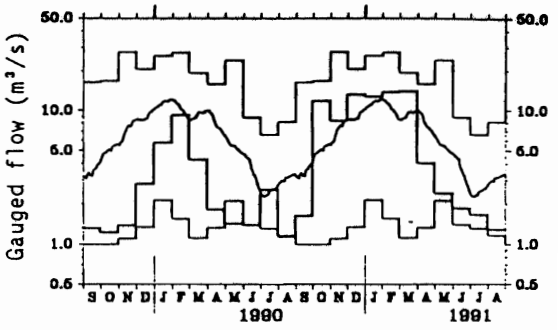
Note: The most recent monthly rainfall figures for England and Wales correspond to the MORECS areal assessments derived by the Meteorological Office; for the Scottish RPBs the August 1991 totals were estimated from the isohyetal map provided with the MORECS bulletin. The regional areal rainfall figures are regularly updated (normally one or two months in arrears) using figures derived from a far denser raingauge network.

FIGURE 2 MONTHLY RIVER FLOW HYDROGRAPHS

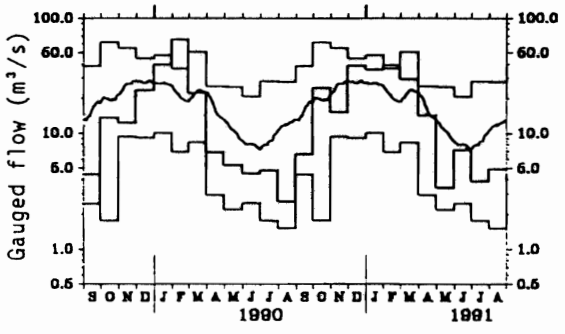
015006 Tay at Ballathie
Monthly mean flows for Sep 1989-Aug 1991
+ extremes and 30 day running mean for 1952-1988



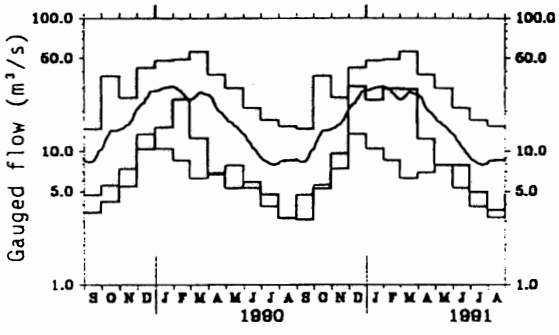
021023 Whiteadder Water at Hutton Castle
Monthly mean flows for Sep 1989-Aug 1991
+ extremes and 30 day running mean for 1969-1988



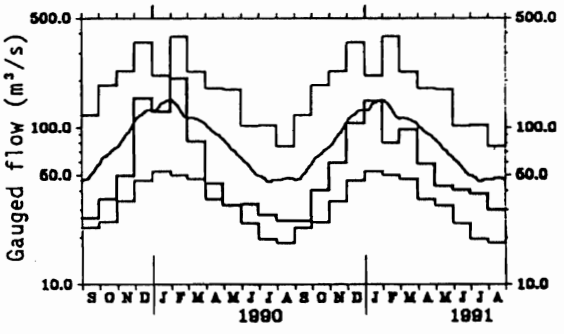
023004 South Tyne at Haydon Bridge
Monthly mean flows for Sep 1989-Aug 1991
+ extremes and 30 day running mean for 1962-1988



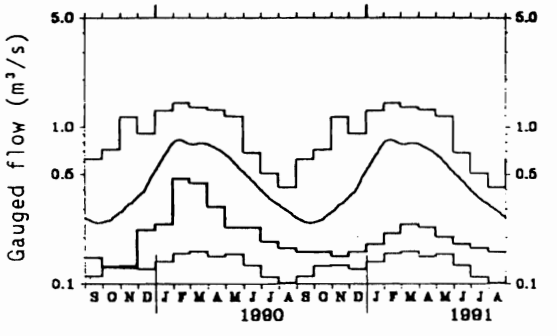
027041 Derwent at Buttercrambe
Monthly mean flows for Sep 1989-Aug 1991
+ extremes and 30 day running mean for 1973-1988



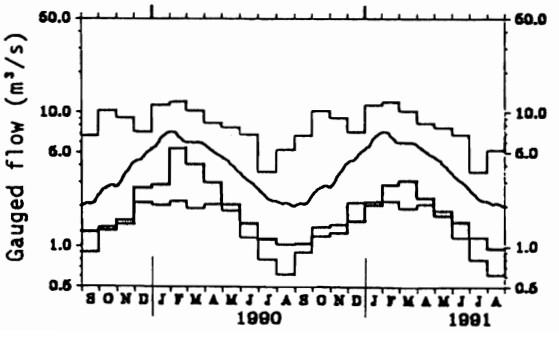
028009 Trent at Colwick
Monthly mean flows for Sep 1989-Aug 1991
+ extremes and 30 day running mean for 1956-1988



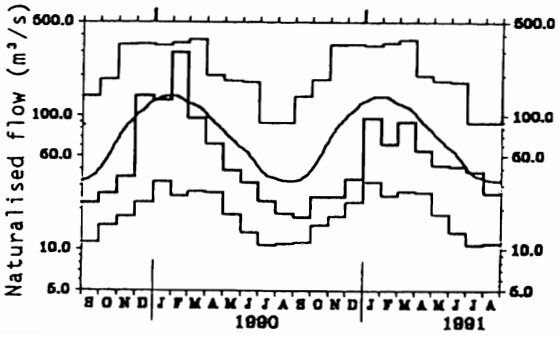
029003 Lud at Louth
Monthly mean flows for Sep 1989-Aug 1991
+ extremes and 30 day running mean for 1968-1988



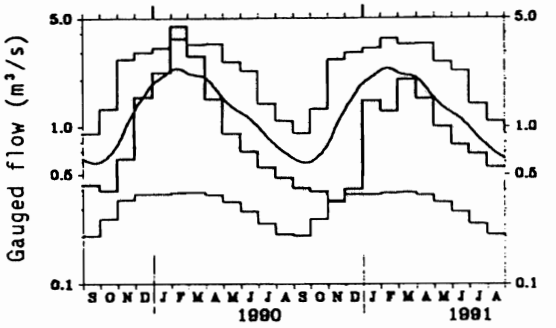
033034 Little Ouse at Abbey Heath
Monthly mean flows for Sep 1989-Aug 1991
+ extremes and 30 day running mean for 1968-1988



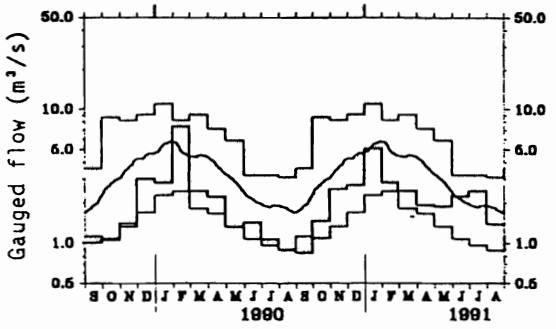
039001 Thames at Kingston
Monthly mean flows for Sep 1989-Aug 1991
+ extremes and 30 day running mean for 1883-1988



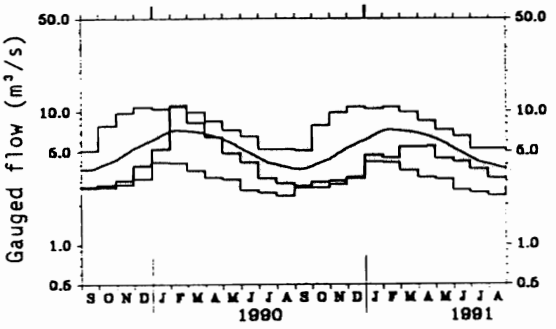
039020 Coln at Bibury
Monthly mean flows for Sep 1989-Aug 1991
+ extremes and 30 day running mean for 1963-1988



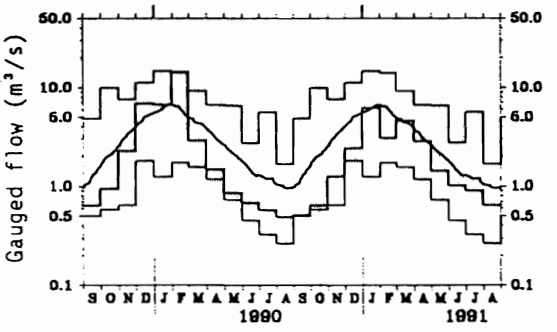
040011 Great Stour at Horton
Monthly mean flows for Sep 1989-Aug 1991
+ extremes and 30 day running mean for 1964-1988



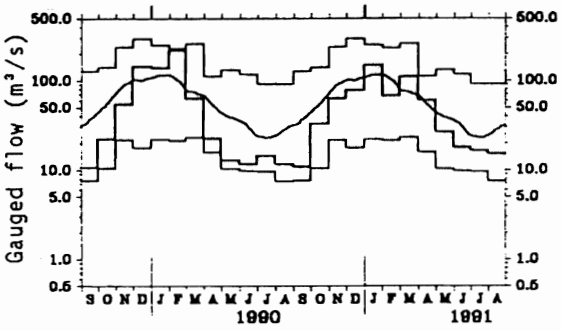
042010 Itchen at Highbridge+Allbrook
Monthly mean flows for Sep 1989-Aug 1991
+ extremes and 30 day running mean for 1958-1988



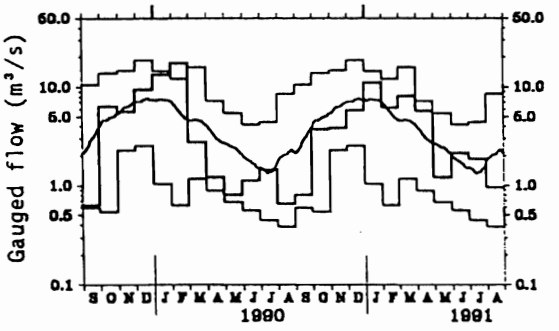
052005 Tone at Bishops Hull
Monthly mean flows for Sep 1989-Aug 1991
+ extremes and 30 day running mean for 1961-1988



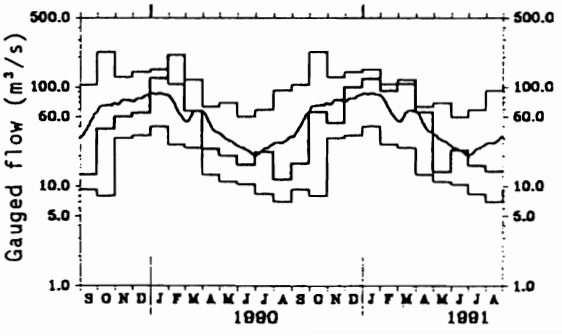
054001 Severn at Bewdley
Monthly mean flows for Sep 1989-Aug 1991
+ extremes and 30 day running mean for 1921-1988



057004 Cynon at Abercynon
Monthly mean flows for Sep 1989-Aug 1991
+ extremes and 30 day running mean for 1957-1988



076007 Eden at Sheepmount
Monthly mean flows for Sep 1989-Aug 1991
+ extremes and 30 day running mean for 1967-1988



084013 Clyde at Daldowie
Monthly mean flows for Sep 1989-Aug 1991
+ extremes and 30 day running mean for 1963-1988

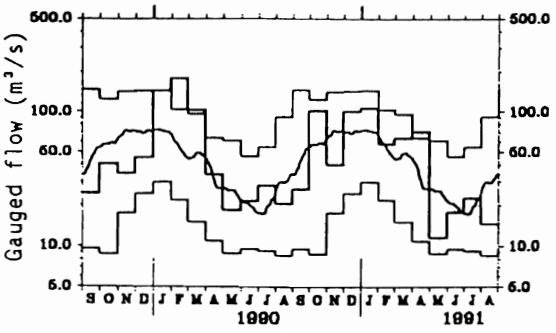


TABLE 3 RUNOFF AS MM. AND AS A PERCENTAGE OF THE PERIOD OF RECORD AVERAGE WITH SELECTED PERIODS RANKED IN THE RECORD

River/ Station name	Apr 1991	May	Jun	Jul	Aug 1991		1/91 to 8/91		3/90 to 8/91		5/89 to 8/91		8/88 to 8/91	
	mm %LT	mm %LT	mm %LT	mm %LT	mm %LT	rank /yrs	mm %LT	rank /yrs	mm %LT	rank /yrs	mm %LT	rank /yrs	mm %LT	rank /yrs
Dee at Park	80 104	41 65	56 153	42 149	17 53	5 /19	526 106	10 /19	1001 89	5 /18	1490 85	2 /17	2133 87	2 /16
Tay at Ballathie	152 183	39 56	50 111	58 146	934 66	11 /39	776 115	32 /39	1705 110	32 /38	2746 112	31 /37	4157 121	35 /36
Whiteadder Water at Hutton Castle	21 57	13 48	10 57	9 70	7 45	6 /22	265 99	10 /22	515 93	7 /21	661 77	6 /20	910 75	5 /19
South Tyne at Haydon Bridge	49 91	12 34	25 93	14 48	17 43	9 /28	473 108	16 /28	935 91	9 /26	1511 91	6 /24	2103 89	4 /22
Wharfe at Flint Mill Weir	53 98	13 34	24 97	18 67	15 37	7 /36	409 95	16 /36	779 80	2 /35	1273 81	2 /34	1922 87	5 /33
Derwent at Buttercrambe	20 64	13 54	13 77	8 56	6 42	3 /30	196 87	11 /30	341 72	4 /29	479 65	2 /28	668 66	1 /27
Trent at Colwick	20 62	15 60	14 74	14 88	11 66	6 /33	187 78	2 /33	356 70	2 /32	615 77	2 /31	862 79	2 /30
Lud at Louth	11 34	10 37	8 39	8 49	8 59	3 /24	75 36	2 /23	180 45	1 /22	287 49	1 /21	421 53	1 /21
Witham at Claypole Mill	11 52	9 57	7 72	5 71	4 57	5 /33	93 68	6 /32	168 62	5 /31	289 70	6 /31	379 67	4 /30
Little Ouse at Abbey Heath	8 43	7 47	6 55	4 48	4 52	2 /24	59 46	2 /23	126 50	1 /22	211 55	1 /22	343 65	1 /21
Colne at Lexden	5 37	5 57	5 93	4 96	3 74	15 /32	49 52	5 /32	93 49	3 /31	186 63	2 /30	293 71	3 /29
Thames at Kingston (natr.)	14 62	11 63	11 87	10 106	7 80	39 /109	118 69	21 /109	216 62	8 /108	418 77	21 /107	571 76	15 /106
Coln at Bibury	37 85	25 75	19 71	17 81	14 83	9 /28	227 76	5 /28	438 75	5 /27	743 83	6 /26	944 78	3 /25
Great Stour at Horton	14 52	15 70	16 104	19 135	11 82	7 /27	153 77	5 /25	282 67	2 /23	445 67	2 /22	599 65	1 /20
Itchen at Highbridge+Allbrook	39 83	33 78	30 86	27 89	23 82	5 /33	259 78	5 /33	564 81	3 /32	874 82	2 /31	1136 80	1 /30
Stour at Throop Mil	35 102	20 85	14 90	14 128	9 88	11 /19	237 89	4 /19	383 71	3 /18	755 88	6 /17	986 82	2 /16
Piddle at Baggs Mill	47 111	28 88	23 99	21 118	15 97	13 /28	252 85	7 /27	461 78	4 /26	765 85	5 /24	973 78	2 /22
Exe at Thorverton	52 92	22 58	24 101	32 155	15 53	14 /36	482 99	14 /35	862 80	3 /34	1536 87	8 /34	2204 87	6 /33
Tone at Bishops Hull	36 93	19 69	13 74	12 78	8 65	6 /31	268 83	8 /30	422 66	2 /30	868 85	4 /29	1192 82	4 /28
Severn at Bewdley	35 111	16 68	11 63	10 71	9 52	20 /71	279 99	34 /70	473 78	8 /69	856 88	16 /69	1226 89	15 /68
Wye at Cefn Brwyn	192 153	34 35	96 114	107 98	178 125	28 /39	1199 104	23 /36	2602 92	9 /32	4392 95	11 /27	6228 98	10 /24
Cynon at Abercynon	141 189	31 52	53 131	47 138	24 48	11 /33	918 129	31 /33	1472 90	8 /31	2816 104	15 /29	3893 102	15 /27
Dee at New Inn	166 161	22 33	67 115	63 94	54 59	10 /23	859 88	7 /22	1969 83	3 /21	3481 88	3 /20	5152 93	5 /20
Eden at Sheepmount	63 138	16 49	26 103	19 70	16 52	7 /21	504 123	19 /21	928 101	11 /19	1541 104	10 /17	2200 106	9 /15
Clyde at Daldowie	96 232	16 46	24 91	32 117	20 49	7 /28	500 116	24 /28	1185 117	23 /27	1897 114	23 /26	2705 116	22 /25

Notes (i) Values based on gauged flow data unless flagged (natr.), when naturalised data have been used.
(ii) Values are ranked so that lowest runoff as rank 1;
(iii) %LT means percentage of long term average from the start of the record to 1990. For the long periods (at the right of this table), the end date for the long term is 1990.

TABLE 4 START-MONTH RESERVOIR STORAGES UP TO SEPTEMBER 1991

Area	Reservoir (R)/ Group (G)		Capacity● (Ml)	1991 Apr (%)▲	May	Jun	Jul	Aug	Sep	[1990 Sep]
North West	Northern Command Zone[1]	(G)	133375	99	90	72	68	55	43	45
	Vyrnwy	(R)	55146	99	96	88	86	83	85	45
Northumbria	Teesdale[2]	(G)	87936	93	82	64	61	52	45	62
Severn-Trent	Clywedog	(R)	44922	95	97	98	99	94	91	57
	Derwent Valley[3]	(G)	39525	97	91	78	74	66	53	39
Yorkshire	Washburn[4]	(G)	22035	99	91	80	72	59	46	47
	Bradford supply[5]	(G)	41407	98	92	76	76	65	50	41
Anglian	Grafham	(R)	58707	85	91	96	96	95	88	74
	Rutland	(R)	130061	78	80	85	80	81	70	71
Thames	London[6]	(G)	206232	89	91	90	91	90	80	62
	Farmoor[7]	(G)	13843	95	100	100	100	100	100	72
Southern	Bewl	(R)	31300	68	79	69	76	78	76	44
	Ardingly	(R)	4627	100	100	100	100	100	93	72
Wessex	Clatworthy	(R)	5364*	100*	95*	84*	71*	59*	47*	54*
	Bristol WW[8]	(G)	36620	93	95	91	79	71	57	43
South West	Colliford	(R)	28540	92	94	91	89	90	86	74
	Roadford	(R)	34500	94	98	98	94	95	89	53[9]
	Wimbleball[10]	(R)	21320	82	84	81	75	73	63	46
	Stithians	(R)	5205	100	96	83	77	66	53	30
Welsh	Celyn + Brenig	(G)	131155	100	99	96	94	89	79	64
	Brianne	(R)	62140	100	97	88	93	93	92	71
	Big Five[11]	(G)	69762	95	96	87	94	92	92	38
	Elan Valley[12]	(G)	99106	99	97	91	91	87	85	58

● Live or usable capacity (unless indicated otherwise)

* Gross storage/percentage of gross storage

▲ Percentage of live or usable capacity in storage at or close to the beginning of the month according to data availability (unless indicated otherwise)

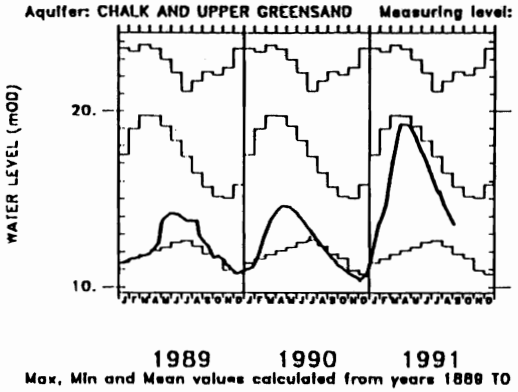
1. Includes Haweswater, Thirlmere, Stocks and Barnacre.
2. Cow Green, Selset, Grassholme, Balderhead, Blackton and Hury.
3. Howden, Derwent and Ladybower,
4. Swinsty, Fewston, Thruscross and Eccup.
5. The Nidd/Barden group (Scar House, Angram, Upper Barden, Lower Barden and Chelker) plus Grimwith.
6. Lower Thames (includes Queen Mother, Wraysbury, Queen Mary, King George VI and Queen Elizabeth II) and Lee Valley (includes King George and William Girling) groups – **pumped storages.**
7. Farmoor 1 and 2 - **pumped storages.**
8. Blagdon, Chew Valley and others.
9. The new Roadford reservoir was still filling after impounding.
10. Shared between South West (river regulation for abstraction) and Wessex (direct supply).
11. Usk, Talybont, Llandegfedd **(pumped storage),** Taf Fechan, Taf Fawr.
12. Claerwen, Caban Coch, Pen y Garreg and Craig Goch.

Note: Variations in storage depend on the balance between inputs (from catchment rainfall and any pumping) and outputs (to supply, compensation flow, HEP, amenity). There will be additional losses due to evaporation, especially in the summer months. Operational strategies for making the most efficient use of water stocks will further affect reservoir storages. Table 4 provides a link between the hydrological conditions described elsewhere in the report and the water resources situation.

FIGURE 3 GROUNDWATER HYDROGRAPHS

Site name: DALTON HOLME

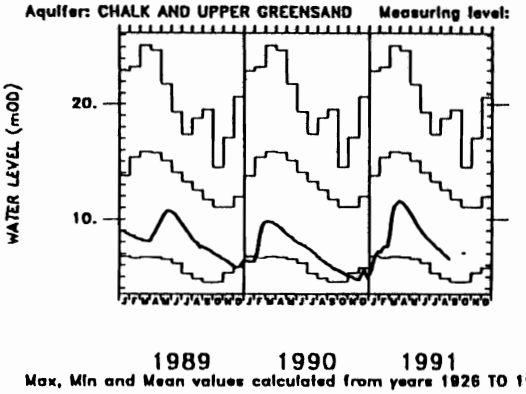
National grid reference: SE 9651 4530 Well number: SE94/5
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 33.50



Max, Min and Mean values calculated from years 1988 TO 1989

Site name: LITTLE BROCKLESBY

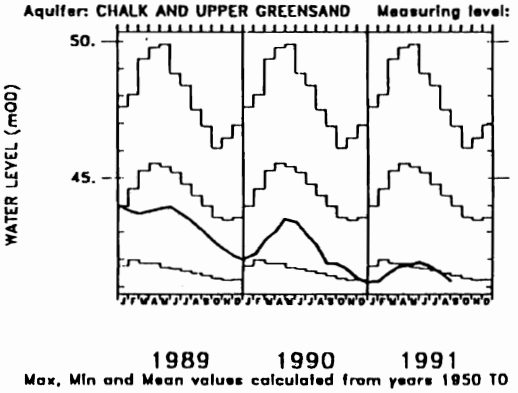
National grid reference: TA 1371 0888 Well number: TA10/40
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 44.33



Max, Min and Mean values calculated from years 1926 TO 1989

Site name: WASHPIT FARM

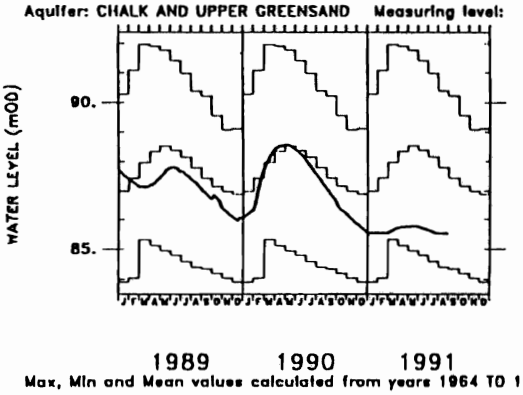
National grid reference: TF 8138 1960 Well number: TF81/2
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 80.20



Max, Min and Mean values calculated from years 1950 TO 1989

Site name: THE HOLT

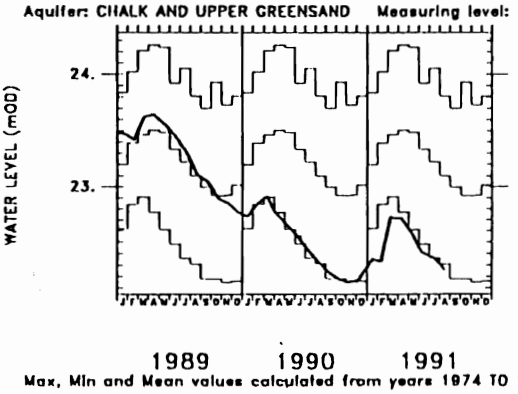
National grid reference: TL 1692 1965 Well number: TL11/9
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 140.21



Max, Min and Mean values calculated from years 1964 TO 1990

Site name: FAIRFIELDS

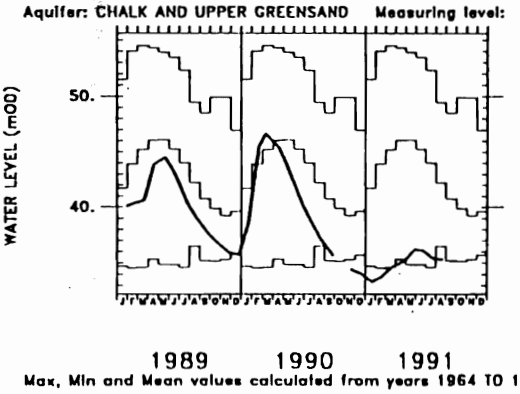
National grid reference: TM 2461 6109 Well number: TM26/46
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 45.00



Max, Min and Mean values calculated from years 1974 TO 1990

Site name: REDLANDS HALL,ICKLETON

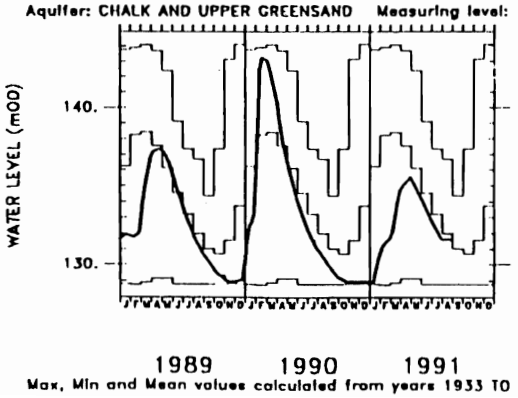
National grid reference: TL 4522 4182 Well number: TL44/12
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 76.19



Max, Min and Mean values calculated from years 1964 TO 1989

Site name: ROCKLEY

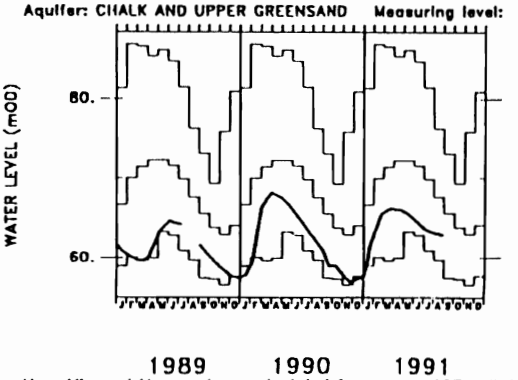
National grid reference: SU 1655 7174 Well number: SU17/57
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 146.39



Max, Min and Mean values calculated from years 1933 TO 1990

Site name: LITTLE BUCKET FARM,WALTHAM

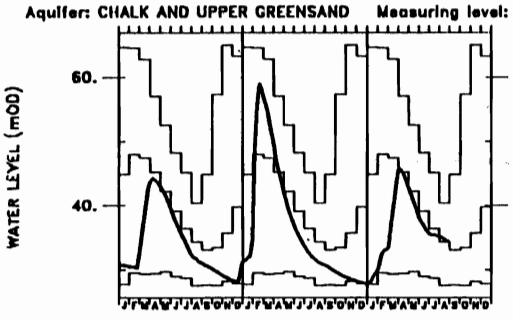
National grid reference: TR 1225 4690 Well number: TR14/9
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 87.33



Max, Min and Mean values calculated from years 1971 TO 1989

Site name: COMPTON HOUSE

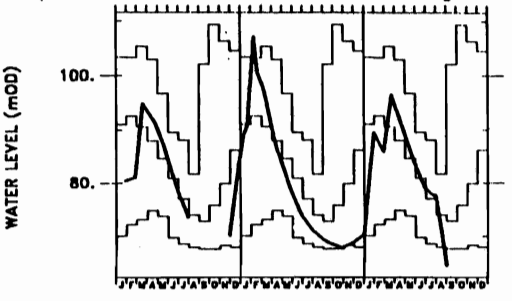
National grid reference: SU 7755 1490 Well number: SU71/23
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 81.37



Max, Min and Mean values calculated from years 1893 TO 1989

Site name: WEST WOODYATES MANOR

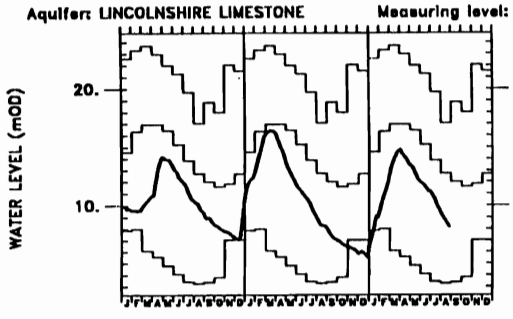
National grid reference: SU 0160 1960 Well number: SU01/58
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 110.93



Max, Min and Mean values calculated from years 1942 TO 1989

Site name: NEW RED LION

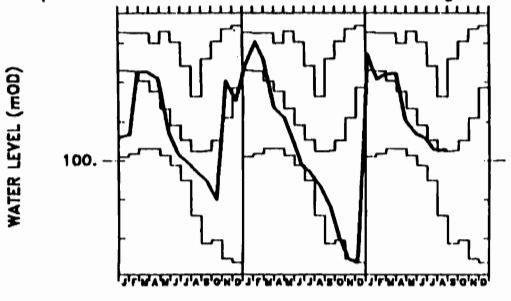
National grid reference: TF 0885 3034 Well number: TF03/37
Aquifer: LINCOLNSHIRE LIMESTONE Measuring level: 33.82



Max, Min and Mean values calculated from years 1964 TO 1989

Site name: AMPNEY CRUCIS

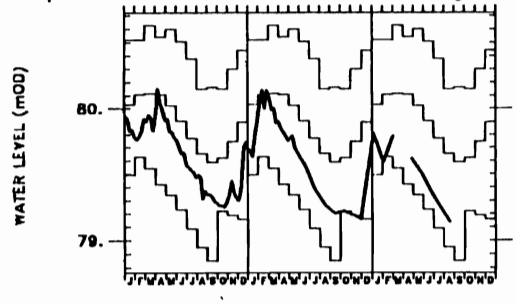
National grid reference: SP 0595 0190 Well number: SP00/62
Aquifer: MIDDLE JURASSIC Measuring level: 109.70



Max, Min and Mean values calculated from years 1958 TO 1990

Site name: LLANFAIR DC

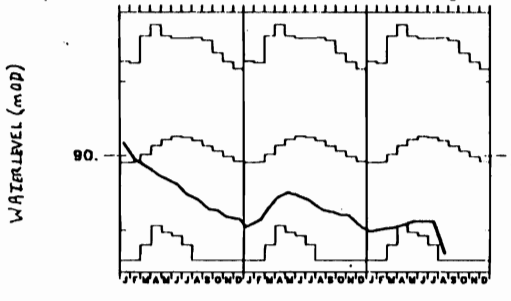
National grid reference: SJ 1374 5556 Well number: SJ15/15
Aquifer: PERMO-TRIASSIC SANDSTONE Measuring level: 82.00



Max, Min and Mean values calculated from years 1972 TO 1990

Site name: WEEFORD FLATS,WEEFORD

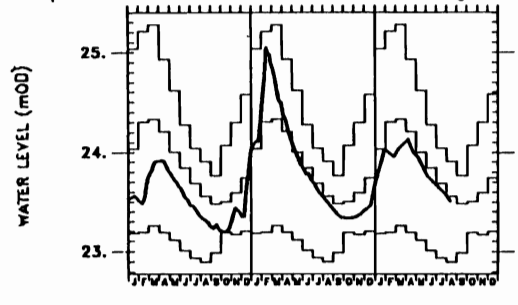
National grid reference: SK 1440 0464 Well number: SK10/9
Aquifer: PERMO-TRIASSIC SANDSTONE Measuring level: 96.21



Max, Min and Mean values calculated from years 1966 TO 1989

Site name: BUSSELS NO.7A

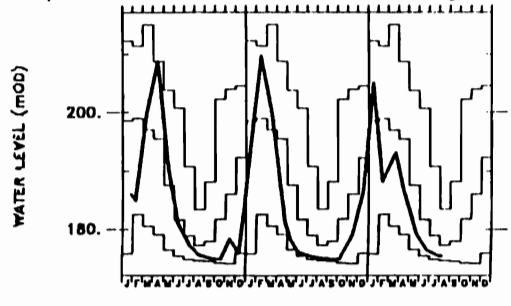
National grid reference: SX 9528 9872 Well number: SX99/378
Aquifer: PERMO-TRIASSIC SANDSTONE Measuring level: 26.07



Max, Min and Mean values calculated from years 1971 TO 1990

Site name: ALSTONFIELD

National grid reference: SK 1292 5547 Well number: SK15/16
Aquifer: CARBONIFEROUS LIMESTONE Measuring level: 280.25



Max, Min and Mean values calculated from years 1974 TO 1989

TABLE 5 A COMPARISON OF AUGUST GROUNDWATER LEVELS : 1991, 1976 AND 1973

Site	Aquifer	Records commence	Average August Level	August 1973		August 1976		August and September 1991		No of years August levels <1991	Lowest pre-1991 level (any month)
				Day	Level	Day	Level	Day	Level		
Dalton Holme	C & UGS	1889	16.44	4/08	14.10	28/08	12.32	5/09	13.55	6	10.34
Little Brocklesby	C & UGS	1926	12.38	14/08	12.12	27/08	4.87	28/08	6.50	2	4.56
Washpit Farm	C & UGS	1950	44.36	1/08	41.48	1/08	41.70	3/09	41.21	0	41.24
The Holt	C & UGS	1964	87.67	26/08	84.39	9/08	85.00	28/08	85.51	4	83.90
Fairfields	C & UGS	1974	23.05	-	-	26/08	22.46	15/08	22.26	0	22.15
Redlands Farm	C & UGS	1964	42.22	1/08	36.83	1/08	36.50	21/08	35.29	0	34.73
Rockley	C & UGS	1933	132.04	26/08	130.94	22/08	dry	30/08	131.59	>10	dry (below 128.78)
Little Bucket Farm	C & UGS	1971	67.28	2/08	61.23	9/08	59.75	29/08	62.84	3	56.77
Compton House	C & UGS	1894	33.96	30/08	30.66	23/08	27.65	8/28	34.39	>10	27.24
West Dean	C & UGS	1940	1.45	22/08	1.11	24/08	1.21	30/08	1.49	>10	1.01
Lime Kiln Way	C & UGS	1969	125.32	30/08	124.85	15/08	124.21	15/08	124.58	1	124.09
Ashton Farm	C & UGS	1974	66.18	-	-	12/08	63.80	1/08	64.30	7	63.10
West Woodyates	C & UGS	1942	74.15	26/08	73.18	1/08	68.71	2/09	64.60	0	67.62
New Red Lion	LLst	1964	12.51	26/08	12.25	24/08	3.29	27/08	8.16	1	3.29
Ampney Crucis	Mid Jur	1958	100.18	5/08	99.99	8/08	99.18	27/08	100.26	>10	97.38
Dunmurry (NI)	PTS	1985	27.97	-	-	-	-	29/08	27.59	1	27.47
Llanfair DC	PTS	1972	79.72	1/08	79.36	1/08	78.95	20/08	79.14	1	78.85
Morris Dancers	PTS	1969	32.55	8/08	32.23	26/08	31.87	19/08	32.03	1	30.87
Weeford Flats	PTS	1966	90.25	17/08	90.08	19/08	88.61	22/08	dry	1	88.61 (dry)
Bussels 7A	PTS	1972	23.54	29/08	23.34	31/08	22.90	13/08	23.51	8	22.90
Rusheyford NE	MgLst	1967	72.96	1/08	64.98	31/08	65.49	15/08	75.34	>10	64.77
Peggy Ellerton	MgLst	1968	34.26	29/08	32.35	23/08	31.17	12/08	33.19	5	31.10
Alstonfield	CLst	1974	176.47	-	-	12/08	174.70	8/08	175.47	7	174.22

Groundwater levels are in metres above Ordnance Datum

C & UGS	Chalk and Upper Greensand	Mid Jur	Middle Jurassic limestones
LLst	Lincolnshire Limestone	MgLst	Magnesian Limestone
PTS	Permo-Triassic sandstones	CLst	Carboniferous Limestone

FIGURE 4 LOCATION MAP OF GAUGING STATIONS AND GROUNDWATER INDEX WELLS